DETAILED ACTION

Claim Rejections - 35 USC § 103

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claims 2, 6, 7, and 9-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sugiura et al (US 2002/0038732) in view of Peng (US 7,130,205) and further in view of Tsuchiya (JP 2003-235252).

Sugiura teaches a dc power supply using a fuel cell, wherein the fuel cell is connected to a rechargeable/dischargeable battery via a DC-DC converter (par. 7 and Fig. 1).

While Sugiura discloses that the output voltage of the DC-DC converter can be varied (par. 42), Sugiura does not teach that the converter comprises a plurality of phases.

Peng teaches that three-phase bridge converters are typical voltage converters used with batteries, fuel cell stacks, etc. (col. 1, lines 19-22). Traditional three-phase voltage converters include six switches, which are controlled by a control unit to provide a desired output (col. 1, lines 25-32). The invention of Peng includes a switch array that is controlled by a control unit to provide single or multiple phase power (col. 3, lines 65-67).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use a three-phase bridge converter in the invention of Sugiura in order to be

able to vary the phases and achieve the desired output, as Peng teaches that such converters are commonly used with fuel cells.

Neither Sugiura nor Peng explicitly describe a control method of the system incorporating varying the phases.

Tsuchiya teaches a method of operating a DC-DC converter, wherein a controller controls a "master" DC-DC converter and "slave" DC-DC converters on the basis of the requested output voltage from the inverter, the input-output current voltage information from the current/voltage sensors, the battery voltage information from the voltage sensor, and others (Abstract). More specifically, Tsuchiya teaches that the master DC-DC converter is made to “certainly drive,” and performs adjustment of the number with slave DC-DC converters (par. 27, lines 2-3). The number, N, is a predetermined number based upon several calculations and determines the control method while maintaining maximum efficiency (pars. 21-26). Operation of the various DC-DC converters is based upon the value of the number, N (par. 27, lines 3-6).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the control method of Tsuchiya in the hybrid fuel cell system of Sugiura and Peng in order to optimize the operating efficiency where at least one to three different phases can be utilized based on need.

Regarding claims 2, 6, and 10, Peng uses the term “converter” to generally include DC-DC, AC-AC, AC-DC, and DC-AC converters (col. 3, lines 46-49). As such, the converter of Peng is capable of handling all types of current. It is assumed that any control method set by an operator or programmer would conduct the phase changes in

a synchronized manner. Furthermore, the control unit of Peng is considered to be capable of conducting the phase changes in a synchronized manner and alternatively, it would have been obvious to one of ordinary skill in the art at the time of the invention to utilize a controller that changes the number of phases in a synchronized manner for the sake of organization and efficiency, as the alternative of a “synchronized” control is a delayed, disorderly, and "out-of-tune" control.

Regarding claims 2, 6, 7, 10, and 11, Tsuchiya teaches that if N=1, only the master DC-DC converter will be in operation, and if N=2, both the master DC-DC converter 31 and the slave DC-DC converter 32 will be in operation, and finally, if N=3, the master DC-DC converter 31 and both of the slave DC-DC converters 32 and 33 will be operational (par. 27, lines 3-6).

Regarding the claimed first and second values being set less than a threshold value at which a total loss of the voltage converter for the single phase drive mode surpasses a total loss of the voltage converter for the multiple phase drive mode, just as an automatic transmission in a vehicle is programmed to shift between the gears at optimal times based upon engine performance and driver input in order to achieve optimum performance, it is considered to be **well** within the purview of one having ordinary skill in the art to be able to determine, through routine experimentation, optimum phase shifts for the converter of Sugiura, as combined with Peng and Tsuchiya, and implement said phase shifts into the controller/control method accordingly. It is considered that such phase shifts would be below the claimed threshold value. Such sophisticated driving control processes are commonplace in

modern technology, which take into account the performance of the driving power (whether it be IC engine, fuel cell, hybrids of both, etc.), input from the driver (desired output), among other properties. Additionally, Tsuchiya teaches throughout the entire disclosure that the N values are calculated based upon the maximum efficiency of each converter.

With regards to claim 9, the fuel cell of Sugiura is considered to be connected to load equipment to power the vehicle. At the very least it would have been obvious to one of ordinary skill in the art at the time of the invention to connect the fuel cell to load equipment because that is how all fuel cells deliver the generated power.

Response to Arguments

Applicant's amendments to the claims have obviated the prior claim Objection.

Applicant's arguments filed March 28, 2011 have been fully considered but they are not persuasive. Applicant argues that the controller of Tsuchiya merely controls the converters based upon the demand output voltage from an inverter, the I/O current and electric-potential-difference information from current/voltage sensors. The rest of this argument is moot because according to the instant disclosure, "value equivalent to a voltage converter input/output conversion energy volume or operation volume" corresponds to the energy associated with voltage conversion or the operating power of the voltage converter, and **specifically** is equivalent to the value of electrical power, the value of current, or some other parameter (par. 12, lines 1-6, PGPub). The instant disclosure explicitly defines said "value equivalent..." to the value of current. It may also

be "some other parameter," so an exact description of said "value equivalent..." is ambiguous. Furthermore, it should be noted that claim 2 does not even require a controller, let alone a controller that is configured to implement the claimed phase changes, and the use of the term "when" makes the limitations followed by "when" conditional. Therefore, they do not necessarily further limit the claim, as instant claim 2 is directed toward the apparatus and not a method of operating the apparatus.

The abovementioned comparison between an automatic transmission and the operation of the converters of the prior art is not to say that the gears of an engine are the same as the phases in the converters, but rather to point out that such control methods are well known in the art. It is commonplace to program such a transmission to shift between gears based upon maximum efficiency. While the prior art (of record) does not explicitly teach that the phase shifts are based in part upon the total losses of each phase, as claimed, at least Tsuchiya explicitly teaches that the phase changes are based upon maximum efficiency. The claimed point where the losses of the single phase surpass the losses of the multiphase operation translates to the point where multiphase operation becomes more efficient than single phase operation. The alternative of the claimed invention is a phase shift that occurs at a point after the total losses under a single phase mode surpass the total losses under a multiple phase mode (in other words, the drive mode shift to multiphase mode at some point after the single phase mode is less efficient than multiphase mode), which is simply inefficient. Just as, for example, first gear shifts to second gear before the first gear is inefficient and just as the purpose of Tsuchiya is to obtain optimum efficiency, it is considered to

be within the purview of one having ordinary skill in the art to be able to determine and implement optimal drive modes for the invention of Sugiura, as combined with Peng and Tsuchiya.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to COLIN W. SLIFKA whose telephone number is (571)270-5830. The examiner can normally be reached on Monday-Thursday, 9:00AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Melvin Curtis Mayes can be reached on 571-272-1234. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/COLIN W SLIFKA/
Examiner, Art Unit 1732

May 23, 2011

/Melvin Curtis Mayes/
Supervisory Patent Examiner, Art Unit 1732